THE FUTURE OF METALS IS DIGITAL
SOLUTIONS FOR THE DIGITAL ERA OF STEEL

PRIMETALS TECHNOLOGIES

PRIMETALS TECHNOLOGIES PROGRAM SCHEDULE

AISTECH 2021 — BOOTH #2035

MONDAY, JUNE 28

Title	Time	Location
Artificial Intelligence and Data-Driven Modeling in Ironmaking – Potential and Limitations	7:30 AM	Virtual
Mastering Fully Automated Steelmaking	9:00 AM	Virtual

Tuesday, June 29

Title	Time	Location
Comprehensive Process Optimization for Electric Steelmaking Route	10:00 AM	Virtual
Installation of Vaicon Slag Stopper at U. S. Steel — Great Lakes Works	10:00 AM	205 A
Revolutionary Endless Strip Production up to 20 mm — Precise and Uniform HSLA Steel	10:30 AM	207 D
Key Challenges for Efficient Descaling	11:00 AM	Virtual
Power Cooling — Advanced Strip Cooling Technology for Hot Strip Mills for Maximum Metallurgical Flexibility, High Cooling Rates and for Saving of Alloying Elements	11:00 AM	207 D
Accelerated Upgrade Plan for Static VAR Compensators	2:00 PM	202 B
Advanced Cooling Technology to Improve High-Strength Plate-Steckel Mill Steel Production	2:00 PM	207 C
Expansion and Modernization of 230-kV Meltshop Substation Using Digital Substation Technologies	2:30 PM	202 B
Revamp of BOF Converters at AK Steel-Middletown Works Using Vaicon Link 2.0 Converter Vessel Suspension System	2:30 PM	205 A
Production of X70 Discrete Plate Using MULPIC	3:00 PM	207 C
Increased Safety and Performance of BOF Relining at Ternium Brazil	3:30 PM	205 A
MIDREX H2 — The Road to CO2-Free Iron and Steelmaking	3:30 PM	201 B
The EAF for Integrated Plants	3:30 PM	204
Digital Substations and Process Bus for Steel Mills — Overview and Quantitative Assessment	4:00 PM	202 B
The Widest ESP Line for U. S. Steel – Full Digitalization Possibilities	4:00 PM	207 D

WEDNESDAY, JUNE 30

Title	Time	Location
Gas Cleaning and Waste Heat Recovery Solutions for Integrated Steel Plants and Mini Mills — State-of-the-Art Technologies and Latest References	11:00 AM	Virtual
Evaluation of the System Dynamics and the Compliance Standards for Large Industrial Motor Starting	3:00 PM	202 B
Key Technologies Supporting the Production of NGO Electrical Steels	3:30 PM	207 B
Cold Rolling Mill Technologies for Electrical Steel	4:00 PM	207 B
How to Eliminate Missed Problems and False Alarms Using Machine Learning for Vibration Monitoring and Analysis	4:00 PM	209 A
Investigation of Grounding Failures in Transformers and Evaluation of Best Practices	4:00 PM	202 B
Full Hydraulic Solution — The Advanced Fourth-Generation Pair Cross Mill	4:30 PM	Virtual

THURSDAY, JULY 1

Title	Time	Location
The Influence of Coke Reactivity on the Raceway Size — A Case Study	7:30 AM	Virtual
Software-as-a-Service in the Metals Industry: Challenges, Requirements and Opportunities	8:00 AM	209 A
New System for Highly Efficient Power Input to Arc Furnaces Causing Minimum Network Disturbances	8:30 AM	204
Techno-Commercial Reasons to Invest in Hot Blast Stoves	8:30 AM	201 A
Reducing Corner Cracks with a New Strategy for Secondary Cooling	9:00 AM	208 A

FRIDAY, JULY 2

Title	Time	Location
Strategies for Smart Maintenance and Asset Management	7:00 AM	Virtual

Monday, June 28

Session: Virtual Program – Digitalization

Artificial Intelligence and Data-Driven Modeling in Ironmaking – Potential and Limitations

The revival of artificial intelligence (AI) promises to offer solutions in particular for complex systems that are difficult to model with classical methods. An overview of AI solutions in ironmaking is provided and their strengths and weaknesses are discussed. Topics such as the applicability for typical problem groups, pre-conditions regarding required data quality and completeness of data sets, reliability, and combination with classical approaches are covered. Further, the deployment and integration of black box models into control systems and the related stability are discussed.

Time: 7:30 AM – 8:00 AM

Location: Virtual

Session: Virtual Program – Digitalization

Mastering Fully Automated Steelmaking

Dynamic LD/basic oxygen furnace/electric arc furnace process control with assisted secondary refining and autonomous steel casting is state-of-the-art upstream technology. The idea of fully automated steelmaking shall raise meltshop automation to a level that enables operators to act primary as supervisors to execute steel production in a safe and reliable manner. Since there is no unified approach to close the gap between current plant-specific operation and the mid-term target of fully automated steelmaking, a digitalization road map draws a structured picture of required measures accompanied by an implementation order considering process development, IT and data infrastructure, meltshop transports and logistics, and maintenance aspects as one.

Time: 9:00 AM – 9:30 AM

Location: Virtual

Tuesday, June 29

Session: Virtual Program – Steelmaking

Comprehensive Process Optimization for Electric Steelmaking Route

Knowing the intensity of peritectic behavior of steel grades during solidification in the mold is essential for adjusting casting parameters in order to cast peritectic steel grades defect-free under stable casting conditions. The peritectic behavior of various steel grades from the whole production spectrum was measured using the Peritectic Expert of the MoldExpert system, which determines the peritectic behavior based on temperature measurements in the mold copper plates and expresses it as a dimensionless peritectic index. Based on these measurements, an analytic correlation between chemical composition and peritectic index for characterizing steel grades could be found.

Time: 10:00 AM – 10:30 AM

Location: Virtual

Tuesday, June 29 (Continued)

Session: Oxygen Steelmaking: Improving Performance & Control

Installation of Vaicon Slag Stopper at U. S. Steel – Great Lakes Works

To improve efficiency and reduce conversion costs, U. S. Steel installed the pneumatic slag retention system from Primetals Technologies on the two 200–ton basic oxygen furnaces in the meltshop at Great Lakes Works. Expected benefits from this project include reduced slag carryover, improved alloy yield and increased steel quality. The Vaicon stopper went into operation in the summer of 2018. The paper describes the equipment, operational results and benefits achieved. In the last part of the paper, an outlook on a new generation of slag stopper is presented.

Time: 10:00 AM – 10:30 AM

Location: 205 A

Session: Hot Sheet Rolling: Emerging Technologies

Revolutionary Endless Strip Production up to 20 mm – Precise and Uniform HSLA Steel

Pair Cross (PC) technology was developed by Primetals Technologies for hot–rolled strip profile control. Since operation of the world's first PC mill in 1984, more than 150 stands have been supplied worldwide and contributing to high–quality strips. The PC mill kept evolving since it was born to correspond to the constantly developing needs of steel market. Lately, the fourth–generation PC mill was launched with full hydraulic control system for better maintainability, meanwhile keeping the high performance of profile control consistent. This paper will introduce the structure and new advanced functions, such as automatic chock position zeroing and automatic leveling compensation.

Time: 10:30 AM – 11:00 PM

Location: 207 D

Session: Virtual Program – Rolling & Processing

Key Challenges for Efficient Descaling

To achieve the Paris Climate Agreement goal of reducing CO2 emissions 80% by 2050, substantial changes to iron and steel production technologies are required. One visionary innovation is based on carbon–free direct steelmaking with Molten Oxide Electrolysis (MOE). Developed by Boston Metal in cooperation with Primetals Technologies, the goal is to reduce the fed iron oxide, using "green" electrons instead of carbon–based fuels. The only products from the process are liquid metal and the by–products electrolyte (slag) and oxygen. This paper describes the process of the MOE technology, the current development status and an outlook of the first industrial demonstrations.

Time: 11:00 AM – 11:30 PM

Location: Virtual

Tuesday, June 29 (Continued)

Session: Hot Sheet Rolling: Emerging Technologies

Power Cooling – Advanced Strip Cooling Technology for Hot Strip Mills for Maximum Metallurgical Flexibility, High Cooling Rates and for Saving of Alloying Elements

Primetals Technologies has introduced a new strip cooling technology for hot strip mills with increased impact pressure to achieve higher strip cooling rates. The automation system with its advanced models is an important and integral part of the solution. With this type of equipment, steel producers can produce new steel grades with higher strength at lower material costs. The lower material costs mainly arise from saving of alloys by applying higher cooling rates. This paper describes this technology and explains different positions of Power Cooling in a hot strip mill supporting different production strategies and benefits.

Time: 11:00 AM – 11:30 AM

Location: 207D

Session: Electrical Applications: I

Accelerated Upgrade Plan for Static VAR Compensators

Static VAR compensators play a vital role in providing power quality compliance and network stability to electric arc furnaces. Considering a typical life cycle of 20 years, upgrading aging SVC equipment ensures maximum meltshop production. Recent increase in production demand from meltshops has challenged maintenance supervisors with fewer and shorter downtimes available for equipment upgrades and servicing. This paper presents an executed plan where a conventional SVC installation and commissioning schedule was compressed from two months to just 11 days. This paper details the execution plan, risk analysis, challenges encountered, and remedial measures taken to ensure on–time start–up.

Time: 2:00 PM – 2:30 PM

Location: 202 B

Session: Plate Rolling

Advanced Cooling Technology to Improve High–Strength Plate–Steckel Mill Steel Production

This paper describes a recent plate–Steckel mill modernization project applying the MULPIC® cooling technology coupled with existing conventional laminar cooling to produce high–strength plate and coil. A description is given of the automation control scheme implemented to give accurate temperature control as well as the advantages of intermediate cooling during the holding phase to improve mill productivity. The paper demonstrates the importance of the advanced model-based automation coupled with sophisticated adaptation. Insights are provided by predictions of the plate temperature and microstructural evolution during cooling. Typical performance results are given, which demonstrate the accuracy that was achieved.

Time: 2:00 PM – 2:30 PM

Location: 207 C

Tuesday, June 29 (Continued)

Session: Electrical Applications: I

Expansion and Modernization of 230-kV Meltshop Substation Using Digital Substation Technologies

This paper presents the principles, implementation and execution methodology of expansion and modernization of an existing 230-kV substation to add two additional bays for a new meltshop expansion. The paper presents the benefits of IEC 61850 and the digital twin solutions used in implementation. The paper further presents the improvements made from phase 1 to accommodate various lessons learned from the existing system design.

Time: 2:30 PM – 3:00 PM

Location: 202 B

Session: Oxygen Steelmaking: Operational Practices & Issues

Revamp of BOF Converters at AK Steel-Middletown Works Using Vaicon Link 2.0 Converter Vessel Suspension System

AK Steel-Middletown Works determined to change their two 225-ton basic oxygen furnace (BOF) vessels. One BOF vessel and trunnion ring were previously fabricated with a bracket support system. After a thorough technical analysis, AK Steel chose to revamp the vessel and trunnion ring to accommodate the Vaicon Link 2.0 suspension system. The first vessel was installed in 2017, the second vessel is fully pre-assembled on-site and ready for installation. The paper describes the principles of the suspension system, the project execution and results from an inspection after 17 months of operation.

Time: 2:30 PM – 3:00 PM

Location: 205 A

Session: Plate Rolling

Production of X70 Discrete Plate Using MULPIC

In late 2019, an advanced runout table cooling system was installed at the SSAB Alabama Inc. rolling mill. The purpose of this upgrade was to expand SSAB's capabilities of offering advanced high-strength steels in wider thickness ranges. Since the installation, an optimized rolling practice with the application of accelerated cooling has been developed for 0.750-inch X70 plate. Plates produced with this practice have been successfully converted to pipes with satisfactory mechanical properties.

Time: 3:00 PM – 3:30 PM

Location: 207 C

Tuesday, June 29 (Continued)

Session: Oxygen Steelmaking: Operational Practices & Issues

Increased Safety and Performance of BOF Relining at Ternium Brazil

Until 2019, Ternium Brazil did the relining of their 340-metric-ton basic oxygen furnace converters through the removable converter bottom. This relining process generated an operational risk for Ternium due to the sensitive area of the refractory bottom joint. In an extensive study, different relining processes were evaluated in order to improve the operational and personal safety of the relining process and in parallel to reduce the relining time. Based on the study results, a new relining machine with winch suspended working platform and elevator was developed together with Primetals Technologies, and was implemented and successfully started up in October 2019.

Time: 3:30 PM – 4:00 PM

Location: 205 A

Session: Direct Reduced Iron: Hydrogen-based DRI

MIDREX H2 – The Road to CO2-Free Iron and Steelmaking

The iron and steel industry must reduce CO2 emissions drastically during the next 30 years. The EU target is an 80% reduction by 2050, which can only be achieved by different production processes. To prepare, many steel producers plan to integrate a direct reduction (DR) plant in their existing steel works. This paper describes the Midrex H2 plant configuration for stepwise increase up to 100% H2 input. An overview about currently ongoing H2 plant projects based on Midrex shaft furnace technology will be given. Furthermore, a feasibility and case study of a DR plant operation based on H2 will be presented.

Time: 3:30 PM – 4:00 PM

Location: 201 B

Session: Electric Steelmaking: EAF Performance I

The EAF for Integrated Plants

EAF Ultimate is designed for all kinds of raw material scenarios. One-bucket charging even for 100% scrap, low electrical energy consumption, improved chemical power input and safety improvements are its key features. Modern and smart automation tools like an automated sand filling system, automated charging system, T+S manipulator, offgas measurement or an automated taphole opener ensure safety and delay reduced productivity. Current performance figures including maintenance costs and lifetime information of all major equipment parts will be shown, together with mechanical solutions to make brownfield implementations possible and workable.

Time: 3:30 PM – 4:00 PM

Location: 204

Tuesday, June 29 (Continued)

Session: Electrical Applications: I

Digital Substations and Process Bus for Steel Mills – Overview and Quantitative Assessment

While digital substations have seen an increase in popularity in the past few years, their adoption has been restricted only to the utilities. This paper explores the finer details of digital substations and provides a comprehensive evaluation of process bus technology for steel mills. A quantitative assessment methodology is presented along with lessons learned and future applications. A centralized protection design is introduced, and modern protection designs are explored. Safety, cost, scalability and integration into Industry 4.0 systems are discussed.

Time: 4:00 PM – 4:30 PM

Location: 202 B

Session: Hot Sheet Rolling: New Capabilities & Product Quality

The Widest ESP Line for U. S. Steel – Full Digitalization Possibilities

U. S. Steel combines its integrated steelmaking process with the widest ESP line ever built to produce advanced high-strength steel grades that assist automotive customers in meeting fuel efficiency standards and Primetals Technologies offers newest digitalization possibilities. Through-Process Optimization (TPO) enables the control and optimization of the production and product quality across the entire process chain. By collecting the right data with Through-Process Quality Control (TPQC) out of all automation systems, measurement systems, smart sensors and even from operators, data are transformed into valuable information, key performance indicators, decisions, advices and actions, enabling a higher level of production and product quality.

Time: 4:00 PM – 4:30 PM

Location: 207 D

Wednesday, June 30

Session: Virtual Program – Environmental

Gas Cleaning and Waste Heat Recovery Solutions for Integrated Steel Plants and Mini Mills – State-of-the-Art Technologies and Latest References

Today steel mills are forced to comply with the most stringent environmental regulations. Two practical examples for achieving ultralow emission levels and best-in-class energy efficiency are presented: the installation of a new electric arc furnace at a steel plant in Italy including a state-of-the art gas cleaning system and a novel type of waste heat recovery solution with record execution time are discussed. Latest innovations for wet- and dry-type ultralow emission gas cleaning for basic oxygen furnace shops are introduced. A novel concept for top gas recovery turbine arrangement for a blast furnace as well as operational achievements are presented.

Time: 11:00 AM – 11:30 AM

Location: Virtual

Wednesday, June 30 (Continued)

Session: Electrical Applications: II

Evaluation of the System Dynamics and the Compliance Standards for Large Industrial Motor Starting

Large motors are ubiquitous in a steel plant. Many of these motors require direct on-line (DOL) starting without speed or torque control. DOL applications create dynamic transients during starting. Using an example of a 10,000-hp motor from a recently executed project, this paper presents the study of the standard power quality compliance requirements, evaluation of the dynamic transients for various system initial states and the effects of these transients on the system. The paper also presents the procedure used for evaluation. Examples of compensation solutions evaluated, and the final solution selected is presented along with the criteria used for selection.

Time: 3:00 PM – 3:30 PM

Location: 202 B

Session: Cold Sheet Rolling: II

Key Technologies Supporting the Production of NGO Electrical Steels

Primetals Technologies' Hyper UC-Mill represents a new generation of mill stand technology specially designed for the production of high-grade non-grain-oriented silicon steels and ultrahigh-strength steels. The 6-high mill features a significantly reduced work roll diameter and a new designed high-torque gear-type spindle. In case of a strip induction heater in front of the cold rolling mill, which is beneficial especially for the production of edge crack-sensitive high-grade electrical steels, the new roll-gap lubrication technology MQL® does not reduce the strip temperature at rolling mill entry as observed for conventional emulsion lubrication.

Time: 3:30 PM – 4:00 PM

Location: 207 B

Session: Cold Sheet Rolling: II

Cold Rolling Mill Technologies for Electrical Steel

Climate change requires urgent attention and corrective actions from the international community. The electric vehicle is expected to be one of the solutions to reduce carbon dioxide emissions. The electric vehicle requires highly efficient electric motors for a long endurance. For this reason, electrical steel sheet production is increasing and market demands have evolved into thinner and harder materials. In response to these market demands, this paper introduces the key technologies such as edge drop control with work roll shift, small work roll application, etc., for harder electrical sheets production focused on the tandem cold mill.

Time: 4:00 PM – 4:30 PM

Location: 207 B

Wednesday, June 30 (Continued)

Session: Digitalization Applications: Analytics 4.0

How to Eliminate Missed Problems and False Alarms Using Machine Learning for Vibration Monitoring and Analysis

Using machine learning (ML) to enhance the power of a vibration monitoring and analysis program has become commonplace. But the challenge of ensuring no problems are missed and identifying root causes remains elusive. As most producers transition from tradition walkaround programs to hybrid solutions and dedicated online systems, solving this challenge has become even more important. Timely information enables operators to react to the right problems quickly. This paper discusses how digitized information is used for supervised and unsupervised machine learning to address the issues of problem identification, no missed problems and no false alarms.

Time: 4:00 PM – 4:30 PM

Location: 209 A

Session: Electrical Applications: II

Investigation of Grounding Failures in Transformers and Evaluation of Best Practices

Typical industrial transformer grounding design includes grounding of the tank, neutral and the control cabinet. The transformer core acts as a magnetic medium to channel the flux and is also grounded. Core grounding may not be seen as a requirement by process or safety. Improper grounding may lead to increased dielectric stresses, leading to internal transformer failures or line-to-ground faults. Investigations of transformer failures due to improper grounding are presented along with solutions to such problems. This paper also presents aspects of transformer grounding, focused on the core ground in order to improve the insulation system, protective relaying and safety.

Time: 4:00 PM – 4:30 PM

Location: 202 B

Session: Virtual Program – Rolling & Processing

Full Hydraulic Solution – The Advanced Fourth-Generation Pair Cross Mill

Pair cross (PC) technology was developed by Primetals Technologies for hot-rolled strip profile control. Since operation of the world's first PC mill started in 1984, more than 150 stands were supplied worldwide and contributing to high-quality strips. PC mill kept evolving since it was born to correspond to the constantly developing needs of steel market. Lately, the fourth-generation PC mill was launched with full hydraulic control system for better maintainability, meanwhile keeping the high performance of profile control consistent. This paper will introduce the structure and new advanced functions, such as automatic chock position zeroing and automatic leveling compensation.

Time: 4:30 PM – 5:00 PM

Location: Virtual

Thursday, July 1

Session: Virtual Program – Cokemaking & Ironmaking

The Influence of Coke Reactivity on the Raceway Size – A Case Study

The formation of the raceway zone in the blast furnace depends on the momentum introduced by the hot blast and other alternative reducing agents and the coke consumption due to thermo-chemical conversion processes. While the influence of the introduced momentum on the raceway size has been evaluated extensively in literature, the sensitivity to the coke reactivity remains unclear. This work will evaluate the effect of the coke reactivity on the raceway size and shape using a systematic approach based on a down-scaled 2D case. The simulative case study is done with an in-house add-on to OpenFO AM®.

Time: 7:30 AM – 8:00 AM

Location: Virtual

Session: Digitalization Applications: Software Innovations

Software-as-a-Service in the Metals Industry: Challenges, Requirements and Opportunities

The idea of software-as-a-service is becoming widely accepted throughout all industries. The benefits of IT systems that are always up to date, continuously supported by experts, and provide functional extensions to the newest developments and technologies are invaluable. Now the first full-featured process optimization system “as-a-service” subscription license model is available, taking the idea one step further by ensuring that higher-level automation systems will never be outdated anymore. This paper describes the challenges and requirements to engineer and implement modern process optimization systems ready for agile software-as-a-service business models, and the opportunities this transition brings for both customers and suppliers.

Time: 8:00 AM – 8:30 AM

Location: 209 A

Session: Electric Steelmaking: EAF Maintenance

New System for Highly Efficient Power Input to Arc Furnaces Causing Minimum Network Disturbances

In order to comply with power quality parameters and to mitigate the disturbing effects of arc furnaces, a compensation system such as SVC or STATCOM is often required to be installed separately on the furnace bus. This paper presents a completely new technology that will actively feed the arc furnace while at the same time minimizing the perturbations caused in the network without any additional compensation. This will result in a paradigm shift in how furnaces will be powered and operated, resulting in increased production while reducing operating and maintenance costs.

Time: 8:30 AM – 9:00 AM

Location: 204

Thursday, July 1 (Continued)

Session: Ironmaking: Blast Furnace Injection & Stove Technologies

Techno-Commercial Reasons to Invest in Hot Blast Stoves

As original designers of hot blast stoves, Primetals Technologies has a long history in developing stove plant from first principles. Understanding the complex nature of optimization of stove plant enables delivery of the required hot blast temperature in the most efficient cost-effective manner. This paper will demonstrate new ideas and concepts that have been developed to meet the desired goals of longer stove life, improved performance, improved efficiency and lower CO2 that can be made in the stove plant area.

Time: 8:30 AM – 9:00 AM

Location: 201 A

Session: Continuous Casting/Metallurgy – Steelmaking & Casting

Reducing Corner Cracks with a New Strategy for Secondary Cooling

Secondary cooling is typically equipped with air-mist nozzles to achieve a wide turndown ratio, without jeopardizing the spray pattern uniformity. To prevent corner cracks, center and margin zones are used. A new cooling system takes the discretization of cooling zones to the next level, making it possible to increase the turndown ratio compared to air-mist systems and significantly by using water-only nozzles, which are driven with a pulse-width modulated signal. Operating costs are reduced through lower air consumption. This paper describes the system itself, the installation at Hyundai steel and the operational results achieved.

Time: 9:00 AM – 9:30 AM

Location: 205 B

Friday, July 2

Session: Virtual Program – Digitalization

Strategies for Smart Maintenance and Asset Management

Presented in a storytelling format, this presentation illustrates how digitalization can support all relevant maintenance activities. This includes everything from choosing the right strategy to defining maintenance intervals or providing instructions on how to perform certain service tasks. The presenters will demonstrate the advantages of automated condition monitoring that unites information from several automation and machine levels to provide actionable information based on the condition of the process and equipment. Further advantages can be realized by integrating such systems and connecting them with experts who can provide prompt support for the daily plant issues faced by metals producers.

Time: 7:00 AM – 7:30 AM

Location: Virtual